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Hedging a bank's interest rate risk with interest rate swaps

Accounting treatment and Auditing procedures

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Abstract

Interest rate risk is one of the most crucial types of risk that banks face as financial intermediaries. This risk can be hedged using traditional methods, like duration matching, or using derivatives such as interest rate swaps, so that banks face less interest rate uncertainty. Hedging with derivatives also has implications for the accounting part. In the light of the IFRS 9, as the new prevailing accounting regime in Europe, this thesis presents the hedge accounting treatment by banks, highlighting the auditor responsibilities in the context of these instruments.

Keywords: *Interest rate risk, Interest rate swaps, IFRS 9, Hedge accounting, Auditor responsibilities*

1. Background and Rationale

One of the most important functions of a bank is the maturity transformation function. This function means that banks generally transform short-term liabilities, such as deposits, into long-term, illiquid and riskier assets, such as mortgage loans, creating a maturity mismatch. Accepting risk is part of a bank's business and the maturity mismatch is a significant source of income for most banks, since long-term interest rates are usually higher than short-term rates. However, it also exposes banks to interest rate risk and excessive interest rate risk can leave the bank's earnings and capital base vulnerable *(BIS, 2016)*. In fact, unexpected changes in interest rates directly affect the Net Interest Income (NII) and the value of the bank (Net Worth). *(Hull, 2012)*

This risk is called Interest Rate Risk in the Banking Book (IRRBB[1]). IRRBB refers to the risk that unexpected changes in interest rates can significantly alter a bank's profitability and market value of equity *(Timothy W. Koch and S. Scott MacDonald, 2003)*. For this reason, finding effective ways of interest rate risk management is very important since interest rate changes may reduce a bank's NII and net worth depending on the bank's balance sheet structure.

In order to mitigate this risk, a bank can use traditional methods like duration matching or it can use derivatives such as interest rate swaps. The regulation for this financial instruments, IAS 39, was replaced by the IFRS 9 since January 2018. For auditors this also poses some challenges.

This thesis will be presented as follows: in sections 2 and 3, the sources and traditional ways to measure and manage interest rate risk are presented as well as the concept of interest rate swaps

[1] Besides the banking book, there is also the trading book which refers to the assets held by a bank with the intention of short-term resale whereas the banking book refers to the assets that are expected to be held to maturity

and the advantages and disadvantages of hedging using these instruments. Section 4 presents the accounting treatment of interest rate swaps, comparing the new with the previous accounting standard. Section 5 presents the auditor responsibilities in the context of this regulation. Then, section 6 presents a practical case using altered data concerning a bank's calculations for measuring the effectiveness of its hedging strategy. Finally section 7 is a reflection presenting the impacts of all of the matters discussed along the thesis and section 8 presents the conclusion.

2. Literature Review

2.1 **Sources of Interest Rate Risk**

As financial intermediaries, banks encounter interest rate risk in several ways. When interest rates change, the present value of future cash flows also changes, and so does the value of a bank's assets, liabilities and off-balance sheet items. Changes in interest rates also affect a bank's earnings by changing interest rate-sensitive income and expenses, affecting its net interest income (NII) *(BIS, 2016).*

IRRBB derives from three important features related to the level and structural features of interest rates: The most important source of interest rate risk is gap risk, which arises from the term structure of banking book instruments and, consequently, from the timing of rate changes. Since rate resets on different instruments occur at different timings, the bank may suffer losses when the interest rate paid on liabilities increases before the interest rate received on assets, or reduces on assets before on liabilities. If not hedged in terms of tenor and amount, the bank may be exposed to a phase of lower interest margins, or may experience changes in the values of its assets and liabilities. *(BIS, 2016).* A short-funded bank, with shorter maturity liabilities than assets, bears a refinancing risk while a long-funded bank incurs reinvestment risk. Due to their business, most retail banks bear a refinancing risk, which means they are negatively affected

by rate increases. This is because if interest rates rise, the short-term liabilities will re-price faster, and at increasing rates, than the longer-term assets. This leaves banks with a weakened balance sheet and a lower NII.

Another source is basis risk which describes the impact of relative changes in interest rates for financial instruments that have similar tenors but are priced using different interest rate indices *(BIS, 2016)*, for instance, an asset priced using Libor funded by a liability priced using US Treasuries.

An additional source of interest rate risk is the existence of options in many bank asset, liability, and off-balance-sheet portfolios. Option risk can be related to option contracts where the holder exercises the option if it is in his interest to do so, for instance, a borrower that exercises the right to prepay a loan or a depositor that withdraws their balance in search of higher yield *(BIS, 2016)*.

Besides the pure economic risks that can arise from changes to the level and structure of interest rates, risks can also arise from the accounting treatment of risk positions, meaning that the interest rate hedging activity may reach the desired economic effect, but fail to achieve hedge accounting treatment (BIS, 2016). The IFRS 9 brought some improvements in this matter that will be discussed later.

2.2 **Traditional Ways to Measure and Manage Interest Rate Risk**

Banks use different methods and approaches to measure and manage the IRRBB. In April 2016, the Basel Committee on Banking Supervision published a paper with new guidelines and standards for interest rate risk management: "Standards on Interest Rate Risk in the Banking Book*"*. These standards focused on a more standardization and comparison of management of

IRRBB between banks and the use of two methods for measuring interest rate risk is advocated: an earnings based method and an economic value based method. *(BIS, 2016)*.

The earnings based method measures, like the repricing gap model, deal with the impact that interest rates have in the NII, whereas the economic value based measures, like the duration gap model, deal with the change in net present value of the bank's balance sheet, or net worth. The two methods are complementary since both reflect the impact of changing cash flows as a result of changing interest rates.

Once banks have done the duration and repricing gap analysis for their institutions, they must decide which alternative strategies to pursue in order to hedge interest rate risk. For example, assuming the bank has a negative repricing gap, meaning a bank's interest-sensitive liabilities exceed its interest-sensitive assets, a rising interest rate will decrease its NII. The bank might decide to eliminate this gap and hedge its NII by buying more interest-sensitive assets like variable rate loans or loans of a shorter maturity and decrease interest-sensitive liabilities. This way, the bank is reducing the repricing gap. In order to have a completely hedged position, the repricing gap would be zero and a change in interest rates wouldn't have any effect on a bank NII in a given period.

In turn, the bank might decide to immunize the market value of its net worth from interest-rate risk by adjusting assets and liabilities so that the duration gap equals zero. Similarly to the repricing gap, the bank might try to shorten the duration of the bank's assets to increase their rate sensitivity either by purchasing assets of shorter maturity or by converting fixed rate loans into adjustable-rate loans. Alternatively, the bank could increase the duration of the liabilities. With these adjustments to the bank's assets and liabilities, the bank would be less affected by interest-rate changes. In these traditional procedures, one would do interest rate risk management by buying and selling assets (*Saunders and Cornett, 2011)*.

The Basel Committee observes that most commercial banks primarily utilize the earnings-based measures for IRRBB management, whereas regulators tend to recommend the use of economic value based measures as a benchmark for comparability and capital adequacy. However, these methods are not flexible since they limit the bank to use assets of certain duration, and some of them might not even be available in the quantities that the bank requires. Also the bank may be constrained to have assets and liabilities of particular durations because of its business model. Besides this, altering the bank's balance sheet might be very costly in the short run *(Mishkin, 2007)*.

In this context, financial instruments such as interest rate swaps, have helped financial institutions manage their interest-rate risk without requiring them to rearrange their balance sheets. This over the counter (OTC) derivatives provide its users flexibility as these can be tailored to meet the specific needs of the user.

2.3 **Interest Rate Swaps: Concept**

The swaps emerged in the late 70s and are one of the greatest innovations in the area of finance. An interest rate swap, hereafter IRS, is a contract between two counterparties whereby they agree to exchange interest payments on a notional during a predetermined period. Usually, there is no upfront costs for the swap agreement, besides the costs of collateral.

The most common type of IRS involves exchanging fixed interest payments for variable interest payments, or vice versa, on the same notional amount, with the same reference (LIBOR, for example). These are known as plain vanilla swaps. The market for interest rate swaps usually uses the London Interbank Offer Rate (LIBOR) as the base for the floating rate. In the Eurozone the rate used is the Euribor rate (Euro Interbank Offered Rate). The counterparty that agrees to pay a fixed rate assumes a long position and is called Payer Swap, while the other that agrees

to pay a variable rate assumes a short position and is called the Receiver Swap. Although there's no exchange of principal it's like the long position sold a fixed rate bond and bought a variable rate one. For example, being in an IRS as fixed rate receiver and floating rate payer is equivalent to the sum of two positions:

1. Long a fixed-rate bond paying a coupon rate. Its value at *t* is:

$$V^{fixed\ leg}(t) = N \times [\sum_{i=1}^{m} \frac{c_n}{n} Z(t, T_i) + Z(t, T_m)]$$

2. Short a floating rate bond. Its value is 100% plus coupon at T1:

$$V^{floating\ leg}(t) = N \times [1 + \frac{I_n(T_0, T_1)}{n}] Z(t, T_1)$$

- c_n is the fixed rate defined at the contract beginning
- T_1 is the next payment date
- $I_n(T_0, T_1)$ is the floating rate fixed at the last reset date T_0 that will be paid at T_1
- $Z(t, T)$ is the spot discount factor implied in the current swap rates

The value of the IRS today is thus

$$V^{IRS}(t) = V^{fixed\ leg}(t) - V^{floating\ leg}(t)$$

The counterparties in a typical swap transaction are a corporation, a bank or an investor on one side (the bank client) and an investment or commercial bank on the other side

3. **Hedging Interest Rate Risk with IRS**

According to *Sinkey (2002*) the purpose of hedging interest rate risk with derivatives is to cancel out or reduce losses in cash or spot markets with gains in derivative markets and hedging can be applied both to individual assets (a micro hedge) or to a bank's balance sheet/ portfolio (a

macro hedge). The aim is to ensure that the value of the hedging instrument fluctuates in the same trend but in opposite direction from the value of the assets and liabilities such that the shareholder value would be protected against interest rate shocks. For banks, since interest rate exposures are present on both sides of the balance sheet, the use of swaps tends to be balanced. Sometimes there is the need to swap from fixed-to-floating, other times from floating-to-fixed, but with the objective of harmonizing the exposures on both sides of the balance sheet, minimizing the interest rate gap.

A traditional bank, one which uses short-term funding to fund long term assets, would require payer swaps, meaning, the bank would pay a fixed rate and receive a variable one in order to hedge for the risk of increasing rates. In this case, IRS can thus reduce interest rate risk by converting a fixed-rate income stream to a variable-rate stream, shorting the duration of assets. This can help overcome the bank's mismatch between long term assets and short term liabilities.

3.1 **Advantages and Disadvantages of Hedging with IRS**

The main advantage of interest rate swaps is their flexibility. As they are traded in the OTC market, they are built to meet the specific needs of each party and they allow the bank to change the interest rate composition of a loan without facing the expense associated with refunding or issuing new debt. Therefore, IRS can be a good hedge against interest rate risk, but hedging with swaps requires constant adjustment. As the situation is changing constantly, as a result of, for example, fluctuating interest rate, new deposits, withdrawals and changing asset and liability compositions, the hedges will need to be adjusted constantly. Also, IRS are subject to the counterparty's credit risk: the chance that the other party in the contract will default. Counterparty risk is more concerning when a swap arrangement covers many years, since the financial condition of the counterparty could change dramatically during that time. This risk has been partially mitigated since the financial crisis, with a large portion of swap contracts

now being cleared through central counterparties (CCPs). However, the risk is still higher than that of investing in a risk-free Treasury bond. Besides, as already mentioned, there is also basis risk, meaning it is possible that changes in the variable rate index used in the derivative contract do not perfectly match changes in the variable rates used to set the pricing on the underlying loan.

4. Accounting treatment of IRS

According to statistics provided by the Bank for International Settlement (BIS) in its 2017 semiannual report, the notional amount of outstanding OTC interest rate derivatives at end-June was of $416 trillion, and of these, $306 trillion were interest rate swaps**.** Thus one can realize the importance of these tools for the financial management of companies. International organizations in the field of accounting and auditing are aware of the importance of these instruments and in that sense have accompanied all this financial progress by upgrading the accounting standards.

The accounting treatment of financial instruments in general, and in particular derivatives, is addressed in the international standards IAS 32 - Financial Instruments: Presentation, IAS 39 - Financial Instruments: Recognition and Measurement, IFRS 7 - Financial Instruments: Disclosures and, currently, in the IFRS 9 - Financial Instruments. The latter, has fully replaced IAS 39 since January 2018. The other two standards also suffered a number of amendments relating to the presentation and disclosure of financial instruments. These developments denote the concern of the IASB and other international organizations with the issue of financial instruments, particularly due to their increasing complexity and, consequently, the increasing difficulty of their measurement and appropriate accounting recognition.

4.1 **IAS 39**

According to the IAS 39, all assets and liabilities are recognized on the balance sheet, including all derivatives, such as the IRS. In the initial measurement, the acquisition cost of financial instruments is their fair value at inception, which in the case of swaps is zero. Thus, at the date of the contract there is no record of any asset or liability (except the record of any amount due by commissions or margins arising from the operation).

Derivatives are recognized at fair value with fair value changes to be recognized in the income statement, except for the use of derivatives to certain hedging transactions. In this case, there are special accounting rules which objective is to ensure the simultaneity between the moment of recognition of fair value changes of the hedging instrument and the hedged item, to avoid creating a fictional volatility in results. However, the use of these special rules is dependent on compliance with a set of very challenging requirements.

Fair values are obtained from quoted market prices, in active markets, if available, or are determined using valuation techniques, including discounted cash flow models and option price models.

4.1.1 **Hedge accounting**

For accounting purposes, hedging means designating a derivative as compensation of income or expense in the fair value or cash flow of the hedged instrument. According to IAS 39, for a transaction to qualify as hedging it is necessary that the criteria of *Appendix 1* are met. This criteria are very rigid and do not always correspond to the concept of hedging from an economic point of view.

Applying normal IAS accounting rules to hedging activities can result in accounting mismatches, when the gains or losses on a hedging instrument are not recognized in the same period and/or in the same place in the financial statements as gains or losses on the hedged item.

This is important since earnings volatility may have a negative effect on a bank's net worth. For example, an interest rate swap is often used to hedge against the risk of exposure to fluctuations in interest payments on a variable rate loan (the hedged item). In this case, the loan would often be held at amortized cost. In turn, the interest rate swap (the hedging instrument) would be held as a non-basic financial instrument with changes in the fair value of the swap being recorded in the profit and loss account. This represents an accounting mismatch because the fair value movements will not necessarily match the effective interest charge. To smooth the impact of this mismatch, the movements in fair value on the interest rate swap can be deferred and released to profit or loss in the same period that the variable interest payments are made, thereby reducing or even eliminating volatility from the profit and loss account.

Derivatives used for hedging are subject to the risk of changes in market conditions, with the risk of the hedging being no longer effective and, consequently, not meeting the hedging relationship conditions. IAS 39 determines that the hedging is effective if the effective coverage efficiency is in a range of 80% to 125%. In this context, the requirements of this accounting standard make it difficult for more complex contracts to be accepted in terms of hedge accounting, for example, long-term loans covered by successive swaps of shorter-term and macro-hedges.IAS 39 requires the ineffective portion of a change in value of the hedging instrument to be recorded immediately in P&L. If the coverage is evaluated and if it is determined that it is no longer effective (is not between 80% and 125%), the hedging relationship no longer meets the hedge accounting criteria, so the swap has to be recognized as an investment derivative.

4.1.2 **Types of hedging associated with IRS**

IAS 39 and now the IFRS 9 permit, in the case of interest rate swaps, two types of hedging relationships: fair value hedges and cash flow hedges.

Fair Value Hedge

If a bank wants to cover a fixed rate asset or fixed rate liability, the goal is to cover the changes in the value of the asset / liability and, therefore, it is faced with a fair value hedging relationship. So here, the bank has a fixed income item and is worried that its value will fluctuate with the market.

For example**,** if a bank has fixed rate bond with coupon 2%, it always knows how much will receive in the future. However, in the future, the market interest rate may be different from 2% so the fair value of the bond could change. Therefore, the bank may enter into an interest rate swap to pay 2% fixed and receive LIBOR12M + 0.5%. This is a fair value hedge since changes in the fair value of the bond are balanced with opposite sign changes in the value of the interest rate swap.

Changes in the fair value of the derivatives that are designated as hedging instruments are recorded in profit or loss, together with any changes on the fair value of the hedged item attributable to the hedged risk (*IAS 39.89*). Gains or losses generated on the ineffective portion are also disclosed in the profit and loss. When the hedging instrument expires, is sold, no longer meets the criteria for hedge accounting or the entity revokes the designation, the derivative financial instrument is transferred to the trading portfolio and fair value hedge accounting is discontinued (*IAS 39.91*). The carrying amount of the hedged item is adjusted by any loss or gain attributable to the hedged risk (basis adjustment), with the other side of the entry taken to profit or loss.

Cash Flow Hedge

On the other hand, when the aim is to cover an element with a variable rate, a bank is faced with a cash flow hedge. Here, it has a variable item and might get less money or have to pay more money in the future than now. So, it wants to fix the amount of money to get or pay so that this amount would be the same now and in the future.

The effective portion of changes in fair value of the hedging derivative is recognized in equity. Any ineffective portion on the hedging instrument is recognized in profit or loss. Amounts accumulated in equity are recycled to the income statement in the periods in which the hedged item affects the income statement.

For instance, a bank issues bonds with coupon LIBOR 12M+0.5%. It means that, in the future, it will pay interest in line with market rates. But if it wants to fix how much to pay in the future, the bank enters into an interest rate swap to receive LIBOR 12 M + 0.5% and pay 2% fixed. This is cash flow hedge since the bank will always pay 2%.

4.2 **From IAS 39 to IFRS 9**

In an attempt to reduce the complexity in accounting for financial instruments, the IASB replaced the IAS 39 with the IFRS 9. The basics of hedge accounting have not changed. However, one of the major changes lies in the measurement of hedge effectiveness.

Testing hedge effectiveness

As in IAS 39, all derivatives under IFRS 9 have to be measured at fair value.

For hedge accounting, the effectiveness assessment and the measurement of ineffectiveness have to be distinguished. The effectiveness assessment is performed to determine which

hedging relationships qualify for hedge accounting and aims to identify accidental offsetting and prevents hedge accounting in those situations. Under the IFRS 9, hedge effectiveness will have to be assessed prospectively at inception and prospectively every reporting period. This prospective tests may be qualitative, such as critical terms match (compare the terms of the hedged item with the terms of the hedging instrument, for example maturity dates, the currencies, interest rates, notional amounts, etc.), or quantitative, like a scenario analysis (simulate various scenarios and analyze how the fair value of the hedged item and hedging instrument change as some other variable changes). In contrast, IAS 39 required an additional effectiveness assessment on a retrospective basis by applying the range of 80%-125% in order to decide whether hedge accounting can be continued or not. *(EY, 2011)*

The measurement of ineffectiveness, on the other hand, refers to the calculation of the 'non-offsetting' amounts in accounting for hedge relationships, i.e. the result in accounting terms. The measurement of ineffectiveness is done only retrospectively and determines the amount to be recorded in profit or loss. The IFRS 9 does not propose any change to this requirement. *(EY, 2011)*

An operation is now considered hedging if there is an economic link between the hedged item and the hedging instrument (i.e., the values of the hedging instrument and hedged item are expected to move opposite directions).This relationship requires some judgment supported by a qualitative or a quantitative assessment of the economic relationship. Also, the values of the hedging instrument and/or the hedged item must not be dominated by credit risk rather than the hedged risk. In this context, IFRS 9 enables an entity to use information produced for risk management purposes and stopped forcing the bank to perform complex analysis required only for accounting purposes. As in IAS 39, any ineffectiveness should be recognized immediately in profit or loss.

Rebalancing

Rebalancing a hedge means adjusting a hedge ratio. It's usually performed when the quantities of a hedge instrument or a hedged item change. IAS 39 required terminating the current hedge relationship and starting the new one. This required the bank to prepare new hedge documentation, assess its effectiveness, etc. IFRS 9 allows certain changes to the hedge relationship without the necessity to terminate it and start a new one. *(IFRSbox.com)*

Discontinuing hedge accounting

IFRS 9 does not allow terminating a hedge relationship voluntarily, so once one decides to apply hedge accounting under IFRS 9, it cannot be discontinued unless the risk management objective changed, the hedge expired or is no longer eligible. IFRS 9 also requires that the hedge documentation includes an analysis of the sources of ineffectiveness, for instance, due to credit risk and how the hedge ratio was determined. *(IFRSbox.com)*The key differences between IAS 39 and IFRS 9 are summarized in *Appendix 2*.

5. Auditor responsibilities

If the most ordinary financial instruments already have risks, derivatives have particular features that leverage these risks, such as having little or no flow of capital required until the maturity of the transactions and the fact that there is no payment or receipt of the nominal amount. This feature of a derivative being settled at a future date together with the fact that, in most cases there is no cash flow associated with the beginning of the contract, imply for the auditor a work of extreme complexity, exacerbated by the fact that the company might, by deliberate occultation or ignorance, not register these contracts. That is why only specific audit procedures may reveal the existence of such contracts. Furthermore, the technical conditions required for hedge accounting to be considered, as well as the potential implications, in case of

ineffectiveness, for the income statement, are determining factors in classifying derivatives as a key audit matter.

The purpose of the audit is to enable the auditor to express an opinion on whether the financial statements are prepared in all material respects, in accordance with the applicable financial reporting system. In order to do so, the auditor should test, for example that the derivatives reported in the financial statements exist at the balance sheet date; make sure that all of the derivatives are reported in the financial statements and ensure that the classification, description and disclosure of derivatives in the financial statements are in accordance with the applicable reporting model.Regular reconciliations with external documents are an important way to control the operations with derivatives. For instance, reconciliation of the records of the counterparty with the records used by the bank; reconciliation of bank accounts as well as extracts of brokers to ensure that all outstanding elements are identified properly. It is important that the auditor does an analysis and assessment of the documentation prepared by the bank to support the criteria defined in IFRS 9 in order to qualify the derivatives as hedges. Analysis of the consistency and completeness of the disclosures related to derivative financial instruments and assessment of compliance with the disclosure requirements are also key.

6. Methodology, Data and empirical results

In order to illustrate the impact of the hedge accounting requirements under the previous regulation IAS 39 and the new regulation IFRS 9, a case study is applied in this dissertation, using altered figures concerning the calculations made by a bank. The research was conducted at Bank A. Both quantitative and qualitative data was acquired with regard to their derivative usage: how derivatives, specifically IRS, were used and the hedge accounting requirements that the bank follows under the previous and the new standard.

Bank A adopted the strategy of minimizing the interest rate risk associated with its fixed rate assets in order to minimize the exposure to movements in interest rates, maintaining a balanced structure between assets and liabilities in terms of interest rate mismatch. For the fixed rate assets, there is a permanent monitoring of their distribution across temporal buckets, net of corresponding fixed rate liabilities and interest rate hedging instruments.

So, the bank enters in derivative transactions with the objective of hedging the fair value changes of fixed rate bonds due to changes in the market interest rates. It uses a fair value hedge (swap of fixed to floating interest rates). The hedged items are the fixed rate bonds of the banking book, shown *in Appendix 3.1* and the hedging relationship is set using bonds individually (micro hedge). The hedging instruments are interest rate swaps, under which a fixed rate is paid and a benchmark rate is received (in this case 3 month Libor with 0% spread), shown also in *Appendix 3.1*. This hedging strategy started at 14/11/2017.

Under IAS 39, the effectiveness testing must be assessed at least quarterly and at each reporting date, using both prospective and retrospective tests. The prospective test used by the bank is the dollar offset method using clean market values, which consists in measuring the hypothetical shift in the underlying interest rate being hedged and the numerical effects of this shift on the fair value of the hedging instrument and hedged item. The retrospective test is similar to the prospective one, but the actual results of the hedge (hedge effectiveness) must fall within the range 80%-125%. In order to show an example of a prospective and a retrospective test, a pair of one hedging (IRS *XY46*) and one hedged instrument (bond *ABC 6, 25%*) of the portfolio were chosen.

Example of a Prospective test

Firstly, the bank computed the present fair value of the IRS (hedging instrument) and the ABC bond (hedged instrument), considering a variation of +100bp and -100bp in the interest rate. The fair value is computed using Bloomberg Swap Manager which allows to create costume deals, inserting the notional, currency, effective date, maturity date and pay frequency for the deal and returns the fair value based on this details. The fair value is calculated as the present value of the estimated future cash flows based on observable yield curves, and considering counterparty credit risk. This calculation was done both for the fixed and for the floated leg. The value of the swap is the net present value of the swap pay and receive legs. The calculations of the present value based on the cash flows and discount factors extracted from Bloomberg Swap Manager are presented in *Appendix 3.2*.Then, the bank compared the change in fair value of the IRS with the change in fair value of the bond, and calculated the expected % of effectiveness of this strategy. (*Appendix 3.3- fixed leg and 3.4- floating leg).* The fixed leg pays semi-annually and the floated leg pays quarterly, which means bank A has to pay semi-annually and receives quarterly.

As of 31/12/2017 the prospective tests show a high probability of the hedging being highly effective (100% effectiveness for the fixed leg and 97% for the floating leg), since changes in the fair value of the hedged item that are attributable to the hedged risk are offset by the changes in fair value of the hedging instrument. The bank performs calculations for the fixed and for the floated leg since it has to cover the risk of both its payments for the fixed leg and its receipts from the floated leg.

Example of a Retrospective test

The retrospective test is similar to the prospective one, but actual variations of the fair value are considered. In this case, the bank compared the fair value of the hedged and hedging instrument at 31/12/2017 with the designation date: 14/11/2017 (*Appendix 3.5-fixed leg and 3.6-floated leg*). The strategy is 99% effective for the fixed leg and 106% for the floating leg.

Due to the novelty of the IFRS 9, this bank is still in conversations with the audit team in order to decide which changes should the effectiveness calculations suffer. Also, it is in a development phase by the bank a new hedging template. For now, the bank procedures are the same, carrying out tests on the hedging effectiveness on a quarterly basis. In this sense, the main change for now relates to the extinction of the obligation of the hedging effectiveness to be in the range 80% to 115%, which nonetheless continues to be the target of the bank's hedging policies, meaning, the bank continues with this objective for the purpose of control, but it may now come slightly out from the range. This is something that the bank has to revisit since the test performed at the moment involves a high subjectivity about what is an acceptable hedging result. Additionally, the periodicity and maturity of the hedging instrument is directly determined by the periodicity and maturity of the hedged item, as with the IAS 39.

7. Impacts

The world's economy has been improving in recent years but interest rates have remained low: the German 1-month Treasury bills yielding -0.53% and US 1-month Treasury bills yielding 1.667%. In Europe, the European Central Bank President Mario Draghi claimed, in January this year, that interest rates will remain steady until the quantitative easing program is concluded by the end of the year, implying that asset purchases will continue until there is a sustained rebound in inflation *(Reuters, 2018)*.

Considering this low interest rate environment, it is likely that, as the economy improves, short-term interest rates will increase in the near future. However, concentrations of long-maturity assets funded with short-maturity liabilities can stress a bank's earnings and capital base in a rising rate environment. Rising short-term rates can squeeze the bank's NII as they are forced

to reprice their short-term funding while some assets loose value. Other factor contributing to increased interest rate risk are earnings pressure to offset losses and to offset higher loan loss provisions (which are expected to increase under IFRS 9). So, a change in monetary policy or investor sentiment can have a significant bad effect if a bank is not actively controlling its interest rate risk exposure. In order to limit the potential damage to their profitability and capital base, it is important that financial institutions plan for likely increases in interest rates and have an active interest rate risk management program that includes the use of financial hedging.

As presented in this dissertation, hedging interest rate risk can be done using traditional methods such as duration matching and/or using derivatives such as interest rate swaps. Hedging with interest rate derivatives can be complex since if these are used incorrectly, they can exacerbate risks rather than hedge them. Institutions should not use derivatives strategies without understanding the risks and how cash flows will behave under a diversity of scenarios.

Banks using derivatives should build a solid hedging strategy, deciding on the risk limits for the hedging activity and decide on procedures for supervising those limits. It is also very important to have limits of authority, having a control of the individuals that are allowed to start hedging transactions. The hedging strategy should also have a description of how management will hedge a specific the asset or liability and measure the hedge effectiveness. In this context, the work of the external auditor is of particular relevance in order to ensure sufficient compliance with the current accounting regulation.

The rules on hedge accounting in the previous regulation IAS 39 have frustrated many preparers, as the requirements have often not been linked to risk management practices. These rules have, sometimes, made achieving hedge accounting impossible or very costly, even where the hedge has reflected an economically rational risk management strategy. So, hedge

accounting under IAS 39 was criticised for being complex rule- based and not aligned with risk management practises.

The problem with the previous regulation was that in order to elect a derivative to hedge accounting, it had to respect a set of very demanding requirements. This may have contributed to many financial and non- financial institutions not using hedge accounting and bear with the volatility in results that this caused. IFRS 9 replaces some of this arbitrary rules by a more principles based requirement. The aim is to provide a better link between an entity's risk management strategy, the rationale for hedging and the impact of hedging on the financial statements. This way, more economic hedging strategies should qualify for hedge accounting. This accounting flexibility also favors new business opportunities and should create a simpler process overall, which represents a chance for companies to reassess their hedging strategies. Past strategies that were rejected because they gave rise to income statement (accounting) volatility might now be used.

Furthermore, it should be easier for users of financial statements to understand hedging activities and the accounting consequences. Investors increasingly focus on risk and how it is managed, so during the development of the standard, they expressed a desire for improved disclosures that would help them better understand a company's risk exposures and risk-management activities. Consequently, the new standard will require enhanced disclosures on hedging activities and the effect that those activities have on the financial statements. This will allow investors to see more clearly the effects of hedge accounting.

The measurement of hedge effectiveness must be consistent with the company's risk management strategies prospective evaluation of the hedge effectivenessIf the new standard brings new opportunities, it also leads to new challenges. The role of the auditor in its core did not change substantially since the actual basics of IAS 39 still remain: hedge accounting

remains optional and there is still the need for documentation and effectiveness assessment, just in a more qualitative manner.

There are extensive qualitative and quantitative disclosure requirements on hedge accounting included in IFRS 7. For example, entities have to disclose a detailed description of their risk management strategy, how hedging activities might affect cash flows and the effect of hedge accounting on the financial statements by risk category (eg interest rate risk, foreign currency risk) and by type of hedge (eg fair value hedge, cash flow hedge) whereas under IAS 39 hedge accounting disclosures were mandatory by type of hedge.

The removal of effectiveness thresholds (80%-125%), allows new hedging relationships that failed this condition to be eligible to hedge accounting. However, this implies an increased level of judgement and subjectivity for the company and for the auditors. Although being a simpler rule, the auditor still might have a more complex work in assessing if the hedge is effective and if all the hedge effectiveness requirements are met in order for a hedging relationship to qualify for hedge accounting. These requirements must be met both at inception of the hedge relationship and prospectively.

8. Conclusion

In order to assess the use of plain vanilla interest rate swaps to reduce interest rate risk, this dissertation started by analysing the different sources of interest rate risk, with the most important being the repricing differences between assets and liabilities. It is part of a bank's business to accept some form of interest rate risk. Therefore it is important for banks to measure and manage interest rate risk appropriately.

The traditional ways to measure and manage this risk were presented. However, these methods restrict the bank to use assets and liabilities of certain duration. So, the use of derivatives, like interest rate swaps, is a way to overcome this lack of flexibility.

Furthermore, it is important to mention the accounting treatment of interest rate swaps that suffered some changes with the new accounting standard IFRS 9 fully replacing the IAS 39. The IFRS 9 is expected to solve most of the problems in terms of hedge accounting of the previous regulation. The major changes in terms of quantitative and qualitative aspects were presented.

Even for most of the accounting community, hedge accounting has been one of the most complicated areas of accounting. The reason for the update to IFRS 9 was to simplify what companies have to do every period, and then also to reduce some of the volatility in the financial statements. Adopting IFRS 9 is not just an accounting change, it could impact risk management practices.

9. References

1. Bank for International Settlements. (2016). Standards on Interest Rate Risk in the Banking Book. https://www.bis.org/bcbs/publ/d368.pdf
2. Bank for International Settlements. (2017). Statistical release: OTC derivatives at end-June 2017. https://www.bis.org/publ/otc_hy1711.pdf
3. Clair, Touhey, Turbeville. (2009). Nowhere to go but up: Managing Interest Rate Risk in a low rate environment
4. Cordeiro da Silva J. (2014). SWAPS: Algumas notas sobre a contabilidade e a auditoria http://www.oroc.pt/fotos/editor2/Revista/65/Auditoria.pdf
5. Delloite (2012) A closer look: Assessing hedge effectiveness under IFRS 9

6. EY (2011) Hedge Accounting under IFRS 9- A closer look at the changes and challenges
7. Hull J. (2012). Options, Futures and Other Derivatives. https://shamit8.files.wordpress.com/2014/11/options-futures-and-other-derivatives-8th-john.pdf
8. International Accounting Standards Board. (2011). International Accounting Standard 39 Financial Instruments: Recognition and Measurement
9. IFRSbox.com. Hedge Accounting IAS 39 vs IFRS 9
10. Memmel, Seymen, and Teichert. (2016). Bank's Interest rate risk and search for a yield: a theoretical rationale and some empirical evidence. https://www.bundesbank.de/Redaktion/EN/Downloads/Publications/Discussion_Paper_1/2016/2016_06_28_dkp_22.pdf?__blob=publicationFile
11. Mishkin. (2007) The economics of Money, Banking and Financial Markets, 8th edition
12. Pereira, J (2017) Class notes of Fixed Income course, Nova SBE
13. Reuters.com (2018). ECB rate rise? You have a very long wait, say economists- Reuters poll. https://uk.reuters.com/article/uk-eurozone-economy-poll/ecb-rate-rise-you-have-a-very-long-wait-say-economists-reuters-poll-idUKKCN1G001R
14. Saunders and Cornett (2011) Financial Institutions Management: A Risk Management Approach 7th Edition
15. IFRS 9: The New Hedging Opportunity?
16. Sinkey, J.F. (2002) Commercial bank financial management: in the financial services industry. 6th edition.Soretha Beets (2004). The use of derivatives to manage interest rate risk in commercial banks.
17. Timothy W. Koch and S. Scott MacDonald (2003). Bank Management, 5th edition

18. Treasurytoday.com (2001). The use of swaps to manage interest rate risk. http://treasurytoday.com/2001/05/the-use-of-swaps-to-manage-interest-rate-risk

10. Appendix

Appendix 1- IAS 39

IAS 39 permits hedge accounting under certain circumstances provided that the following criteria are met: ***[IAS 39.88]***

(a) At the inception of the hedge there is formal designation and documentation of the hedging relationship and the entity's risk management objective and strategy for undertaking the hedge. That documentation shall include identification of the hedging instrument, the hedged item or transaction, the nature of the risk being hedged and how the entity will assess the hedging instrument's effectiveness in offsetting the exposure to changes in the hedged item's fair value or cash flows attributable to the hedged risk.
(b) The hedge is expected to be highly effective in achieving offsetting changes in fair value or cash flows attributable to the hedged risk, consistently with the originally documented risk management strategy for that particular hedging relationship.
(c) For cash flow hedges, a forecast transaction that is the subject of the hedge must be highly probable and must present an exposure to variations in cash flows that could ultimately affect profit or loss.
(d) The effectiveness of the hedge can be reliably measured, ie the fair value or cash flows of the hedged item that are attributable to the hedged risk and the fair value of the hedging instrument can be reliably measured
(e) The hedge is assessed on an ongoing basis and determined actually to have been highly effective throughout the financial reporting periods for which the hedge was designated.

Source: IAS 39

Appendix 2- Key differences between IAS 39 and IFRS 9

Requirement	IAS 39	IFRS 9
Risk component as eligible hedged item	Financial items	All items
80%-125% test	✓	X
Prospective effectiveness testing	✓	✓
Retrospective effectiveness testing	✓	X
Quantitative effectiveness test	✓	Depends*
Qualitative effectiveness test	X	Depends*
All ineffectiveness must be recognised	✓	✓
Accounting for 'costs of hedging'	X	✓
Rebalancing of hedge ratio	X	✓
De-designation (risk management objective unchanged)	✓	X
Discontinuation (risk management objective changed or other qualifying criteria not met)	✓	✓
Partial de-designations and discontinuations	X	✓

* No method is specified by IFRS 9. A qualitative assessment may be appropriate if it captures the relevant characteristics of the hedging relationship including the sources of ineffectiveness

Source: EY June 2015

Appendix 3.1

Hedging instruments: IRS

Currency	Security	Counterparty	Effective date	Maturity date	IRS Fixed rate	Notional	Notional designated at 14/11/2017	% designated as hedging instrument	Designation date
USD	**XY46**	**Bank1**	**24/06/2015**	**23/06/2023**	**2,250%**	**20.000.000**	**7.740.000**	**38,70%**	**14/11/2017**
USD	XY47	Bank1	18/11/2016	18/11/2023	1,905%	10.000.000	7.260.000	72,60%	14/11/2017
USD	XY48	Bank2	01/09/2016	01/09/2024	1,376%	15.000.000	10.000.000	66,67%	14/11/2017
USD	XY49	Bank3	14/07/2016	14/01/2025	2,165%	20.000.000	5.000.000	25,00%	14/11/2017
Total						**65.000.000**	**30.000.000**	**46%**	

Hedged instruments: Fixed rate bonds

Currency	Desgination	Hedging instrument	Maturity date	Portfolio	Bond Fixed rate	Nominal	Desination date
USD	**ABC 6,25% 11/23**	**XY46**	**01/11/2023**	**AFS**	**6,25%**	**7.740.000**	**14/11/2017**
USD	XYG 6,125% 04/24	XY47	24/04/2024	AFS	6,125%	2.500.000	14/11/2017
USD	GHY 5,89 01/24	XY47	29/04/2024	AFS	5,893%	4.760.000	14/11/2017
USD	DFG 4,21% 06/24	XY48	29/04/2024	AFS	4,21%	10.000.000	14/11/2017
USD	EDH 4,5% 07/24	XY49	19/04/2024	AFS	4,50%	5.000.000	14/11/2017
Total						**30.000.000**	

Appendix 3.2

PROSPECTIVE TEST
Designation date: 14-11-2017
Bucket in USD
Fixed Leg

IRS XY46

Payment Dates	Payments(Pay)	Discount	Fair Value
27/12/2017	(54.944,4)	1	(54.944,4)
25/06/2018	(222.500,0)	0,9916	(220.630,2)
24/12/2018	(223.750,0)	0,9817	(219.654,0)
24/06/2019	(225.000,0)	0,9710	(218.472,7)
23/12/2019	(223.750,0)	0,9599	(214.784,6)
23/06/2020	(225.000,0)	0,9487	(213.455,6)
23/12/2020	(225.000,0)	0,9375	(210.940,2)
23/06/2021	(225.000,0)	0,9267	(208.511,3)
23/12/2021	(225.000,0)	0,9162	(206.140,0)
23/06/2022	(225.000,0)	0,9055	(203.737,5)
23/12/2022	(225.000,0)	0,8947	(201.316,8)
23/06/2023	(225.000,0)	0,8840	(198.907,9)
FV IRS			**(2.371.495,0)**

IRS XY46
+100bp

Payment Dates	Payments(Pay)	Discount	Fair Value
27/12/2017	(54.944,4)	1	(54.944,4)
25/06/2018	(222.500,0)	0,9868	(219.559,7)
24/12/2018	(223.750,0)	0,9720	(217.492,8)
24/06/2019	(225.000,0)	0,9566	(215.239,5)
23/12/2019	(223.750,0)	0,9410	(210.546,3)
23/06/2020	(225.000,0)	0,9253	(208.190,1)
23/12/2020	(225.000,0)	0,9098	(204.701,0)
23/06/2021	(225.000,0)	0,8943	(201.214,1)
23/12/2021	(225.000,0)	0,8785	(197.670,7)
23/06/2022	(225.000,0)	0,8639	(194.379,1)
23/12/2022	(225.000,0)	0,8494	(191.124,9)
23/06/2023	(225.000,0)	0,8351	(187.902,9)
FV IRS			**(2.302.965,6)**

IRS -100bp

Payment Dates	Payments(Pay)	Discount	Fair Value
27/12/2017	(54.944,4)	1	(54.944,4)
25/06/2018	(222.500,0)	0,9964	(221.708,4)
24/12/2018	(223.750,0)	0,9915	(221.841,9)
24/06/2019	(225.000,0)	0,9856	(221.762,5)
23/12/2019	(223.750,0)	0,9793	(219.118,9)
23/06/2020	(225.000,0)	0,9727	(218.867,8)
23/12/2020	(225.000,0)	0,9662	(217.385,8)
23/06/2021	(225.000,0)	0,9604	(216.087,1)
23/12/2021	(225.000,0)	0,9555	(214.983,1)
23/06/2022	(225.000,0)	0,9492	(213.561,9)
23/12/2022	(225.000,0)	0,9425	(212.072,7)
23/06/2023	(225.000,0)	0,9359	(210.582,4)
FV IRS			**(2.442.916,7)**

ABC 6.25% 11/23

Payment Dates	Payments(Rcv)	Discount	Fair Value
01-05-2018	80.786,3	0,9944	80.332,1
01/11/2018	87.075,0	0,9847	85.741,1
01/05/2019	87.075,0	0,9742	84.830,3
01/11/2019	87.075,0	0,9631	83.863,6
01/05/2020	87.075,0	0,9520	82.891,1
02/11/2020	87.558,8	0,9406	82.360,3
04/05/2021	88.042,5	0,9296	81.844,3
01/11/2021	85.623,8	0,9192	78.702,8
03/05/2022	88.042,5	0,9085	79.986,4
01/11/2022	86.107,5	0,8978	77.307,2
02/05/2023	87.558,8	0,8871	77.672,8
23/06/2023	24.740,4	0,8840	21.871,3
FV ABC bond			**917.403,2**

ABC 6.25% 11/23
+100bp

Payment Dates	Payments(Rcv)	Discount	Fair Value
01/05/2018	80.786,3	0,9911	80.063,8
01/11/2018	87.075,0	0,9764	85.021,7
01/05/2019	87.075,0	0,9612	83.699,5
01/11/2019	87.075,0	0,9455	82.326,7
01/05/2020	87.075,0	0,9298	80.964,5
02/11/2020	87.558,8	0,9141	80.036,7
04/05/2021	88.042,5	0,8986	79.113,2
01/11/2021	85.623,8	0,8830	75.607,0
03/05/2022	88.042,5	0,8680	76.418,2
01/11/2022	86.107,5	0,8535	73.495,8
02/05/2023	87.558,8	0,8392	73.479,3
23/06/2023	24.740,4	0,8351	20.661,3
FV ABC bond			**890.887,8**

-100bp

Payment Dates	Payments(Rcv)	Discount	Fair Value
01/05/2018	80.786,3	0,9977	80.601,9
01/11/2018	87.075,0	0,9930	86.468,3
01/05/2019	87.075,0	0,9874	85.979,2
01/11/2019	87.075,0	0,9811	85.433,0
01/05/2020	87.075,0	0,9747	84.868,3
02/11/2020	87.558,8	0,9680	84.757,3
04/05/2021	88.042,5	0,9618	84.675,8
01/11/2021	85.623,8	0,9569	81.929,5
03/05/2022	88.042,5	0,9510	83.726,6
01/11/2022	86.107,5	0,9444	81.323,6
02/05/2023	87.558,8	0,9378	82.114,8
23/06/2023	24.740,4	0,9359	23.155,0
FV ABC bond			**945.033,5**

PROSPECTIVE TEST
Designation date: 14-11-2017
Bucket in USD
Floated Leg

IRS XY46

Payment Dates	Payments(Pay)	Discount	Fair Value
27-12-2017	34.315,2	1	34.315,2
23/03/2018	80.010,6	0,9962	79.702,9
25/06/2018	91.948,6	0,9916	91.175,9
24/09/2018	97.906,6	0,9868	96.610,9
24/12/2018	103.334,2	0,9817	101.442,5
25/03/2019	108.469,0	0,9764	105.909,0
24/06/2019	111.403,8	0,9710	108.171,9
23/09/2019	114.040,4	0,9655	110.104,2
23/12/2019	115.702,7	0,9599	111.066,6
23/03/2020	117.292,0	0,9543	111.935,8
23/06/2020	118.958,3	0,9487	112.854,7
23/09/2020	119.334,7	0,9431	112.540,3
23/12/2020	118.451,9	0,9375	111.050,1
23/03/2021	117.780,1	0,9320	109.773,8
23/06/2021	114.525,3	0,9267	106.132,5
23/09/2021	115.069,2	0,9214	106.026,5
23/12/2021	114.337,2	0,9162	104.753,2
23/03/2022	115.739,5	0,9109	105.427,8
23/06/2022	119.412,0	0,9055	108.127,6
23/09/2022	120.173,3	0,9001	108.167,0
23/12/2022	119.594,6	0,8947	107.006,2
23/03/2023	119.057,0	0,8894	105.894,8
23/06/2023	122.430,8	0,8840	108.233,1
FV IRS			**2.356.422,5**

IRS XY46
+100bp

Payment Dates	Payments(Pay)	Discount	Fair Value
27/12/2017	34.315,2	1	34.315,2
23/03/2018	80.010,6	0,9939	79.522,4
25/06/2018	144.185,3	0,9868	142.279,9
24/09/2018	148.463,4	0,9795	145.422,0
24/12/2018	153.890,0	0,9720	149.586,5
25/03/2019	159.024,7	0,9644	153.358,1
24/06/2019	161.959,5	0,9566	154.933,7
23/09/2019	164.596,0	0,9488	156.170,6
23/12/2019	166.258,3	0,9410	156.447,3
23/03/2020	167.847,5	0,9332	156.628,2
23/06/2020	170.073,7	0,9253	157.367,4
23/09/2020	170.450,2	0,9175	156.383,0
23/12/2020	169.007,6	0,9098	153.760,1
23/03/2021	168.444,3	0,9022	151.967,7
23/06/2021	176.660,1	0,8943	157.984,5
23/09/2021	178.539,7	0,8864	158.252,6
23/12/2021	178.377,3	0,8785	156.711,0
23/03/2022	167.360,0	0,8712	145.811,7
23/06/2022	169.900,4	0,8639	146.778,1
23/09/2022	170.291,3	0,8566	145.873,8
23/12/2022	168.795,5	0,8494	143.382,4
23/03/2023	168.555,6	0,8423	141.981,9
23/06/2023	172.933,8	0,8351	144.421,2
FV IRS			**3.289.339,2**

IRS -100bp

Payment Dates	Payments(Pay)	Discount	Fair Value
27/12/2017	34.315,2	1	34.315,2
23/03/2018	80.010,6	0,9984	79.884,2
25/06/2018	39.718,4	0,9964	39.577,1
24/09/2018	47.349,8	0,9941	47.069,9
24/12/2018	52.778,4	0,9915	52.328,3
25/03/2019	57.913,4	0,9886	57.253,7
24/06/2019	60.848,2	0,9856	59.972,6
23/09/2019	63.484,8	0,9825	62.373,4
23/12/2019	65.147,1	0,9793	63.798,7
23/03/2020	66.736,6	0,9760	65.137,9
23/06/2020	67.844,4	0,9727	65.995,3
23/09/2020	68.220,8	0,9694	66.135,8
23/12/2020	67.896,3	0,9662	65.598,6
23/03/2021	67.147,3	0,9629	64.657,8
23/06/2021	52.875,3	0,9604	50.780,8
23/09/2021	51.998,1	0,9579	49.808,8
23/12/2021	50.575,6	0,9555	48.324,0
23/03/2022	64.062,0	0,9524	61.014,5
23/06/2022	68.815,1	0,9492	65.316,8
23/09/2022	69.932,3	0,9459	66.145,9
23/12/2022	70.257,8	0,9425	66.221,1
23/03/2023	69.466,9	0,9393	65.249,0
23/06/2023	71.826,4	0,9359	67.223,9
FV IRS			**1.364.183,5**

ABC 6.25% 11/23

Payment Dates	Payments(Rcv)	Discount	Fair Value
01-02-2018	(23.552,1)	0,9985	(23.516,6)
01/05/2018	(32.047,3)	0,9944	(31.867,2)
01/08/2018	(36.322,9)	0,9897	(35.950,0)
01/11/2018	(39.722,2)	0,9847	(39.113,7)
01/02/2019	(41.317,1)	0,9795	(40.468,1)
01/05/2019	(41.559,1)	0,9742	(40.487,7)
01/08/2019	(44.046,9)	0,9687	(42.668,6)
01/11/2019	(44.921,0)	0,9631	(43.264,3)
03/02/2020	(46.569,0)	0,9574	(44.583,2)
01/05/2020	(43.975,9)	0,9520	(41.862,9)
03/08/2020	(47.124,0)	0,9462	(44.588,2)
02/11/2020	(45.754,1)	0,9406	(43.037,6)
01/02/2021	(46.033,0)	0,9351	(43.043,9)
04/05/2021	(45.523,6)	0,9296	(42.318,8)
02/08/2021	(43.447,5)	0,9244	(40.163,3)
01/11/2021	(44.134,2)	0,9192	(40.566,9)
01/02/2022	(45.114,6)	0,9138	(41.227,7)
03/05/2022	(45.545,8)	0,9085	(41.378,2)
01/08/2022	(45.331,0)	0,9032	(40.943,3)
01/11/2022	(46.629,9)	0,8978	(41.864,2)
01/02/2023	(46.926,0)	0,8924	(41.876,2)
02/05/2023	(46.198,0)	0,8871	(40.982,0)
23/06/2023	(27.144,0)	0,8840	(23.996,2)
01/11/2023	(7.787.764,1)	0,8763	(6.824.679,1)
			(7.734.448,1)
FV ABC bond			**(909.769,0)**

ABC 6.25% 11/23
+100bp

Payment Dates	Payments(Rcv)	Discount	Fair Value
01/02/2018	(23.552,1)	0,9976	(23.495,8)
01/05/2018	(51.179,4)	0,9911	(50.721,7)
01/08/2018	(56.105,4)	0,9839	(55.203,5)
01/11/2018	(59.496,7)	0,9764	(58.093,7)
01/02/2019	(61.099,1)	0,9688	(59.191,0)
01/05/2019	(60.691,3)	0,9612	(58.338,6)
01/08/2019	(63.828,6)	0,9534	(60.852,4)
01/11/2019	(64.702,6)	0,9455	(61.174,3)
03/02/2020	(66.783,8)	0,9374	(62.601,8)
01/05/2020	(62.891,4)	0,9298	(58.478,0)
03/08/2020	(67.338,7)	0,9218	(62.073,2)
02/11/2020	(65.319,0)	0,9141	(59.707,6)
01/02/2021	(65.598,1)	0,9064	(59.458,8)
04/05/2021	(67.442,5)	0,8986	(60.602,5)
02/08/2021	(67.194,9)	0,8908	(59.860,3)
01/11/2021	(68.642,0)	0,8830	(60.611,9)
01/02/2022	(68.637,9)	0,8753	(60.075,5)
03/05/2022	(64.948,0)	0,8680	(56.372,9)
01/08/2022	(64.381,5)	0,8608	(55.420,2)
01/11/2022	(65.964,3)	0,8535	(56.302,8)
01/02/2023	(66.282,6)	0,8463	(56.094,1)
02/05/2023	(65.372,1)	0,8392	(54.860,2)
23/06/2023	(38.286,6)	0,8351	(31.974,0)
01/11/2023	(7.807.154,8)	0,8249	(6.440.271,1)
			(7.721.835,9)
FV ABC bond			**(1.281.564,8)**

-100bp

Payment Dates	Payments(Rcv)	Discount	Fair Value
01/02/2018	(23.552,1)	0,9994	(23.537,5)
01/05/2018	(12.913,9)	0,9977	(12.884,4)
01/08/2018	(16.541,5)	0,9956	(16.468,5)
01/11/2018	(19.944,1)	0,9930	(19.805,2)
01/02/2019	(21.535,7)	0,9903	(21.326,3)
01/05/2019	(22.425,8)	0,9874	(22.143,6)
01/08/2019	(24.265,8)	0,9843	(23.885,5)
01/11/2019	(25.140,1)	0,9811	(24.666,0)
03/02/2020	(26.355,9)	0,9778	(25.771,1)
01/05/2020	(25.059,0)	0,9747	(24.424,0)
03/08/2020	(26.911,1)	0,9713	(26.138,2)
02/11/2020	(26.189,2)	0,9680	(25.351,3)
01/02/2021	(26.467,9)	0,9647	(25.533,7)
04/05/2021	(23.705,8)	0,9618	(22.799,3)
02/08/2021	(19.869,0)	0,9593	(19.060,3)
01/11/2021	(19.760,9)	0,9569	(18.908,3)
01/02/2022	(21.646,4)	0,9542	(20.654,7)
03/05/2022	(26.104,7)	0,9510	(24.825,1)
01/08/2022	(26.236,0)	0,9478	(24.865,6)
01/11/2022	(27.245,7)	0,9444	(25.731,9)
01/02/2023	(27.523,0)	0,9411	(25.901,8)
02/05/2023	(26.988,6)	0,9378	(25.310,6)
23/06/2023	(15.976,8)	0,9359	(14.953,0)
01/11/2023	(7.768.323,4)	0,9311	(7.232.930,0)
			(7.747.876,1)
FV ABC bond			**(514.946,1)**

Appendix 3.3

PROSPECTIVE TEST
Designation date: 14-11-2017
Bucket in USD
Fixed Leg

Increase of 100bp in the interest rate							
			31/12/2017	+100bp			
IRS XY46	Notional	Coupon	FV of the IRS	FV of the IRS	Var. FV		
	20.000.000	2,25%	(2.371.495,0)	(2.302.965,6)	68.529,4		
			31/12/2017	+100bp			
Bond ABC 6.25%	Notional	Coupon	FV of the bond	FV of the bond	Var. FV	Weighting	Effectiveness
	7.740.000	2,25%	917.403,2	890.887,8	(26.515,4)	39%	=-68.529,4*39%/26.514,4=100%

Decrease of 100bp in the interest rate							
			31/12/2017	-100bp			
IRS XY46	Notional	Coupon	FV of the IRS	FV of the IRS	Var. FV		
	20.000.000	2,25%	(2.371.495,0)	(2.442.916,7)	(71.421,7)		
			31/12/2017	-100bp			
Bond ABC 6.25%	Notional	Coupon	FV of the bond	FV of the bond	Var. FV	Weighting	Effectiveness
	7.740.000	2,25%	917.403,2	945.033,5	27.630,3	39%	100%

Appendix 3.4

PROSPECTIVE TEST
Designation date: 14-11-2017
Bucket in USD
Floated Leg

Increase of 100bp in the interest rate							
			31/12/2017	+100bp			
IRS XY46	Notional	Coupon	FV of the IRS	FV of the IRS	Var. FV		
	20.000.000	2,25%	2.356.422,5	3.289.339,2	932.916,8		
			31/12/2017	+100bp			
Bond ABC 6.25%	Notional	Coupon	FV of the bond	FV of the bond	Var. FV	Weighting	Effectiveness
	7.740.000	2,25%	(909.769,0)	(1.281.564,8)	(371.795,8)	39%	97%

Decrease of 100bp in the interest rate							
			31/12/2017	-100bp			
IRS XY46	Notional	Coupon	FV of the IRS	FV of the IRS	Var. FV		
	20.000.000	2,25%	2.356.422,5	1.364.183,5	(992.238,9)		
			31/12/2017	-100bp			
Bond ABC 6.25%	Notional	Coupon	FV of the bond	FV of the bond	Var. FV	Weighting	Effectiveness
	7.740.000	2,25%	(909.769,0)	(514.946,1)	394.822,9	39%	97%

Appendix 3.5

RETROSPECTIVE TEST
Designation date: 14-11-2017
Bucket in USD
Fixed Leg

			14/11/2017	31/12/2017			
IRS XY46	Notional	Coupon	FV of the IRS	FV of the IRS	Var. FV		
	20.000.000	2,25%	(2.374.997,1)	(2.371.495,0)	3.502,1		
			14/11/2017	31/12/2017			
Bond ABC 6.25%	Notional	Coupon	FV of the bond	FV of the bond	Var. FV	Weighting	Effectiveness
	7.740.000	2,25%	918.777,8	917.403,2	(1.374,6)	39%	99%

Appendix 3.6

RETROSPECTIVE TEST
Designation date: 14-11-2017
Bucket in USD
Floated Leg

			14/11/2017	31/12/2017			
IRS XY46	Notional	Coupon	FV of the IRS	FV of the IRS	Var. FV		
	20.000.000	2,25%	2.271.567,5	2.356.422,5	84.855,0		
			14/11/2017	31/12/2017			
Bond ABC 6.25%	Notional	Coupon	FV of the bond	FV of the bond	Var. FV	Weighting	Effectiveness
	7.740.000	2,25%	(878.743,5)	(909.769,0)	(31.025,5)	39%	106%